STATION PAPER NO. 2 SEPTEMBER 1946

POSTWAR PROBLEMS OF THE CROSS TIE INDUSTRY IN THE LAKE STATES

ARTHUR G. HORN AND HAROLD F. SCHOLZ

RECEIVED
JAN 17 1947
FOREST INSECT LABORATORY
MILWAUKEE, WISC.

DIVISION OF FOREST ECONOMICS

LAKE STATES FOREST EXPERIMENT STATION

UNIVERSITY FARM, ST. PAUL 1, MINN.

E. L. DEMMON, DIRECTOR

U. S. Department of Agriculture, Forest Service
Lake States Forest Experiment Station[1]

Station Paper No. 2 September 1946

POSTWAR PROBLEMS IN THE CROSS TIE INDUSTRY IN THE LAKE STATES

By Arthur G. Horn and Harold F. Scholz

TIE MAKING

In volume of wood consumed annually in the Lake States, railroad ties rate fourth, being only surpassed by lumber, pulpwood, and fuelwood. During the ten-year period 1935 to 1945, approximately 4 million cubic feet of wood were used annually for cross ties.

Railroads, including those used in logging and mining, are the principal tie users. Industrial plants, electric railways, and switching and terminal companies account for less than 5 percent of the total consumption.

The estimated average employment in the Lake States tie industry is 3,000 workers. The number fluctuates from a low point in summer to a maximum in midwinter. Of these 3,000 workers, about 2,500 are employed in the woods and mills, and 500 work in treating plants. Under normal conditions 5 million sawed and hewed ties are produced annually. Their value after treatment amounts to approximately 8 million dollars. Hewed ties represent but a small percent of the total. For example, during the 1943-1944 season the hewn tie output amounted to only 3.5 percent of total tie production.

The prevailing wage scales in the tie manufacturing industry have been somewhat lower than those for other industries. This lower pay has not discouraged many local workers, especially farmers who are anxious to increase their income by obtaining jobs in the woods and mill or by harvesting and marketing logs from their own woodlands. Full time employees currently are paid about $1,800 a year as against $1,300 in the late 1930's.

A general reconnaissance and numerous contacts with loggers and foresters lead us to believe that the Lake States has passed the peak in tie production. Even in the face of recent improvements in equipment and in logging and milling techniques, the above holds true. The closing of a number of the remaining large lumber mills, the declining supply of old growth stumpage, rising costs, and competition from other wood-using industries are the main factors which have accounted for the decline in the regional cut of ties during the past five years.

Although the annual production of ties in the Lake States has fallen off in recent years, there is no reason to believe the industry must be relegated to one of minor importance. There are several ways to prevent a further decline in the annual output. A few of the most obvious remedies are: (1) increased utilization of the so-called less desirable hardwoods such as soft maple, elm, and black ash; (2) improved methods of logging, milling, and handling; (3) better woods practices, especially leaving small trees of low economic value and the better integration of operations, i.e., rough logs unsuitable for veneer and quality sawed products going into ties.

---

[1] Maintained at University Farm, St. Paul, Minnesota, in cooperation with the University of Minnesota.

HOW TIES ARE PRODUCED AND MARKETED

The tie industry in the Lake States is made up of the following related, but more or less separate segments: (1) medium and small producers, (2) treating plants, (3) distributors or tie contractors.

Medium Size Tie Producers

The typical medium sized tie manufacturing concern employes 25 to 30 men in the mill and woods and produces 30 to 50 thousand ties per year. Although the investment in equipment varies, two southwestern Wisconsin operators each producing about 35 thousand ties annually indicated an equipment inventory of about $20,000 apiece in 1944.

Milling equipment varies, but the following description indicates its general character. Ties are usually manufactured by semi-stationary mills, sufficiently well designed and assembled to produce products of standard grades. Either diesel, gasoline, or electric power units are used to drive the headsaw. Other milling equipment includes an edger, cut-off saws, and occasionally a surfacing unit.

The equipment and methods employed in handling logs and finished products at the mill also vary. Logs ordinarily are brought to the deck of the sawmill by trucks equipped with hoists, but sometimes this is done by a bull chain. In most cases lumber and slabs are moved by means of the truck-mounted hoists. Ties also are handled in this manner, or if they are dried along a railroad siding they may be loaded at the mill directly on trucks.

Normally, lumber is air dried in piles at least 90 days, but ties ordinarily are sold green. Recently a few operators have held their ties to take advantage of the premium for seasoning, but in general they are not favorably inclined to tying up capital and taking the risks (losses from splitting, etc.) for this phase of the business.

In the medium-sized operations, a combination of hand labor and power equipment is employed to get out logs. Both gasoline and electric power saws and hand tools are used for felling and bucking. Some operators prefer hand labor to the power saw, especially for logging inaccessible pockets, excessively steep slopes, and areas where underbrush is heavy. Skidding is done with horses or medium-sized crawler-type tractors. A caterpillar tractor with a bulldozer is used for making truck roads and as an auxiliary power for helping loaded trucks over difficult stretches of road. Many concerns have equipped their logging trucks with power-loading devices of the boom or cross-haul type.

Mainly, 8- and 8½-foot tie bolts are produced, but some 10-to 16-foot logs are cut for veneer or lumber. Usually these longer logs are put on trucks by hand because the standard power loading unit is designed for placing the shorter tie bolts crosswise on the trucks. From 25 to 30 tie bolts (1 to 1½ M log scale) are hauled per load for an average distance of 10 to 15 miles.

Except when interrupted by seasonal shortages of labor, occasional breakdowns, and bad weather, the medium-sized tie mills operate on a year-round basis. For this reason they seldom build up large inventories of logs. Most operators buy timber on short-term contracts and usually have at least a 12 to 18 months' supply on hand.

Medium-sized tie concerns are the natural heirs of the large steam-operated sawmills, which in the heyday of lumbering, fifty or more years ago, were converting the virgin forests into lumber, dimension stock, ties, shingles, etc. Since 1900, company after company has cut out and either moved on to new timber reserves in other regions or has liquidated.

With the end of the old-growth timber in sight in most parts of the Lake States, it seems only a matter of 10 to 20 years before most of the remaining large mills will close. As the larger mills shut down they are replaced gradually by the intermediate-sized ones using semi-permanent or portable mills. Mills of this latter type can operate efficiently in second-growth and small, isolated blocks of old-growth timber. Thus, they are better suited to the production of railroad ties and box and crating lumber than the large mills they supplanted. Undoubtedly, this latter will produce the preponderance of the ties manufactured in the Lake States in the future.

Tie producers with medium-sized mills are typically well financed, have good outlets for their products, employ standard business methods, and are also able to diversify their final products to take advantage of premium prices which are offered from time to time.

Small Tie Operators

It is estimated that small mills with an annual output of less than one million board feet of products each, saw about one-third of the ties manufactured in the Lake States. The number of ties turned out by a single small operator varies from a few hundred to several thousand.

Characteristically, the small mill is powered by a steam engine or a medium to heavy gasoline farm tractor. In some instances it may be driven by a stationary gasoline or diesel motor. Such mills usually have a saw rig of light to medium-heavy design. In addition to the headsaw, some mills have an edger and cut-off saw. A truck or two usually comprises the balance of the heavy equipment, investment rarely exceeds five thousand dollars, and more commonly would be less than a thousand dollars.

Portable custom mills, mounted on truck and trailer units which can be moved and set up in a few hours are a recent development.

Owners of small mills ordinarily move them one or more times each year. They operate on a seasonal schedule from late fall to late spring, and the rest of the year they do threshing, hay bailing, silo filling, etc. From five to fifteen men are employed depending whether the service is strictly one of milling or a combination of logging and manufacturing. Not infrequently the small mill owner is a farmer.

Usually the small mill operator saws on a custom or contract basis. Less commonly he buys stumpage or logs. He charges farmers or other woodland owners who do their own logging and marketing at established custom rates, but makes individual agreements with professional buyers of logs and standing timber, covering unit prices for milling. He may or may not furnish such additional services as the piling of ties and lumber or the delivery of these products to railroad sidings or other marketing points.

The small-sized, tie-manufacturing concern of today should not be confused with the itinerant operator of several decades ago. Mill owners of this latter class usually bought one or two blocks of farm woods a year and subsequently cut them clean. They needed only a minimum amount of capital. Sometimes they sold the ties directly to the railroad but more often to a small town jobber who handled ties as a side line. That was an era of cheap stumpage, low labor costs, and an expanding economy. As often as not, farmers wanted to get rid of their timber so pastures and croplands could be expanded.

Wood Preserving Operations

Generally speaking, common carrier railroads in the Lake States have taken advantage of the various preservative treatments and mechanical devices that lengthen the life of ties. Prior to the war they treated about 90 percent of their ties. Even during the war years when treating plants were short of labor and delays were frequent and sometimes lengthy, railroads continued to use approximately the same proportion of treated ties. About the only untreated ties used were such durable woods as northern white cedar and white oak.

Logging railroads and industrial plants maintaining track facilities seldom require treated ties. The life of logging roads is too short to justify this additional expense. Industrial plants use a high percentage of "cull" ties purchased from local tie mills. Because of the poor mechanical strength of such ties treatment is not warranted as they break down from wear rather than decay.

Preservative treatment and improved mechanical devices such as tie plates have lengthened the average life of ties. That these have been important conservation measures is proven by the fact that ties frequently last 25 to 30 years now as contrasted with 2 to 12 years a few decades ago.

Following an inspection at the tie mill, ties are shipped green to the treating plants where they are air dried, preferably for three or four months of good drying weather. After seasoning, the ties are adzed, bored, and incised before a preservative is forced into the wood under pressure. In recent years the Rueping and Lowery processes, with either creosote or petroleum oil as the preservative, have been used by plants operating in the Lake States.

There are six pressure-treating plants operating in the Lake States. These concerns, in addition to one in Iowa, treat practically all the cross ties produced in the region.

Marketing System

Products of tie mills are marketed in several different ways. Sometimes the owners negotiate directly with the railroad for tie contracts and sell their lumber, slabs, veneer logs, etc., elsewhere. Under this arrangement the operators take all the risks, but stand to realize to the fullest extent on profits.

The other common marketing method is through jobbers or contractors. They assume responsibility for sales and collections and charge the tie mill operators a commission for this service. These middlemen often assist the producers by buying stumpage and advancing money for operating expenses. Some sixty tie contractors supplied ties to the railroads in this region

during the war, but a considerably smaller number operate in peacetime. The increase in number of middlemen occurred shortly after the Office of Price Administration authorized an increase of twenty cents per tie to contractors.

Normally, railroad purchasing agents buy ties from eight to twelve months in advance of actual needs to allow sufficient time for seasoning and treating. They determine the number of ties to be replaced from track inspection reports. Through long experience, railroad officials have learned the kind of cross ties best suited for their particular needs. They give full consideration to the location of their lines in relation to timber supply, location of treating plants, and the anticipated volume of business.

Usually, procurement officers for the railroads meet with tie dealers early in the fall and agree on terms and specifications for ties to be supplied during the ensuing year. Each railroad issues its own specifications as to species, grades, and length. Principal users demand that all ties must be free from decay, splits, shakes, and numerous large knots that impair strength or durability. Likewise they require that ties are free from bark and reasonably straight, well cut, and square at both ends.

ANNUAL CONSUMPTION AND PRODUCTION

Prior to the war about five million ties were used annually on 32,774 miles of Lake States' railroads (table 1). Requirements for replacements for the period 1935-1940 were about 150 ties per mile. During the war years the regional producers were unable to meet the demands, especially in the better species. Renewals were 134 per mile in 1942; 113 in 1943; and 128 in 1944. To meet their needs, the railroads were forced to draw on reserve stocks and in extreme cases had to use green and untreated ties. To supplement local supplies many carloads of ties were imported from the southern and western states and Canada.

Table 1.- Annual cross tie replacement, by states, for Lake States, 1942 to 1944.

State	Miles of Track 1/	Tie Replacements			
		Estimated Normal	1942	1943	1944
Minnesota	12,507	1,875,000	1,600,000	1,400,000	1,700,000
Wisconsin	10,668	1,600,000	1,600,000	1,200,000	1,400,000
Michigan	9,599	1,440,000	1,200,000	1,100,000	1,100,000
Region	32,774	4,915,000	4,400,000	3,700,000	4,200,000
Replacements per mile		150	134	113	128

1/ Includes main roadway, second and third main line tracks, industrial yard, and terminal tracks.

Cross ties acquired by railroads of the region during the war were used primarily to keep existing trackage in good operating condition. Only a small number were used for new road construction.

The largest output of ties in the war period occurred during the 1943-1944 season, when 700 sawmills manufactured 4,120,000. In addition, some 150,000 hewed ties were produced for a grand total of 4,270,000 or the equivalent of about 145 million board feet. Nearly one-half of these ties or 1,908,000 came from Wisconsin; 1,320,000 from Michigan; and 970,000 from Minnesota. Approximately 83 percent of the 1943-1944 output were hardwoods and 17 percent were softwoods. Oak, birch, maple, and aspen made up the bulk of the hardwood ties while softwood ties consisted mainly of cedar and hamlock. Since 1944, tie production has fallen off. Preliminary figures show that only about 3 million ties were produced during the 1945-1946 season.

Normally, most of the railroads in the Lake States prefer white and red oak, hard maple, and birch ties for main line tracks, especially on curves where wear is heavy. They use cedar, hemlock, and pine ties primarily on secondary tracks or on main line straightaways. During World War II railroads were unable to purchase sufficient ties of preferred species. Thus, in the 1943-1944 season tie users purchased nearly 800,000 aspen, elm, black ash, and other miscellaneous hardwood ties. They bought fewer of these latter mentioned hardwoods in 1945, again giving preference to oak, hard maple, and birch.

Throughout war years most tie users eased up on quality specifications. For example, they graded very few ties as serviceable rejects or culls during 1943-1944. This leniency of tie inspectors no doubt was due to the short supply and the keen competition for usable ties. For the foregoing period approximately one-third of the ties produced by Lake States mills were graded No. 5's and No. 4's; another third No. 3's; and the rest No. 2's, No. 1's, and serviceable rejects. Cull ties amounted to less than one percent of the total production. Since early 1945 the tie inspectors have adhered more closely to engineering specifications.

There seems to be a growing demand by some Lake States railroads for larger ties. This demand is expected to continue and perhaps become more pronounced as passenger and freight train schedules are speeded up to help railroads compete with other modes of travel.

Although they preferred hewed ties before treating was the accepted practice, common carrier railroads in recent years have shown preference for sawed ties, principally because of their more uniform size. During the 1943-1944 season they purchased less than 150,000 hewed ties, a relatively small number compared to the middle 1930's when the current annual rate of production was slightly more than a million hewed ties.

MAJOR PROBLEMS FACING THE INDUSTRY

A number of problems currently beset the tie industry of the Lake States. The most important ones are: (1) the declining supply of raw materials, (2) rising costs, (3) competition from other industries. Their scope and probable effect on tie production is discussed herewith in some detail.

Declining Supply of Raw Material

One of the major problems of the tie industry in the Lake States is the decline in the volume of stumpage. Take a few examples. Northern Minnesota for many years provided a considerable volume of paper birch, northern white cedar, and tamarack for ties. Prolonged overcutting has practically exhausted this supply

About the same situation prevails in northern Wisconsin where yellow birch, northern white cedar, sugar maple, and tamarack are the principal tie species. The mixed oak forests of southern Wisconsin and Minnesota and the northern hardwood stands of Michigan likewise have been logged extensively. However, considerable timber remains in these latter areas, and they will be the principal source of tie stumpage in the Lake States in the years immediately ahead.

It seems doubtful whether the hardwood forests of the Lake States, especially farm woodlands, will be managed specifically for tie production. In general, tie stumpage commands too low a price compared to veneer and sawlogs to make such an objective attractive. The possibility that the railroads can afford to pay enough for manufactured ties to compete with quality lumber or veneer appears very unlikely.

Rising Costs

Since 25 to 30 percent of the total cost of producing a tie is the outlay for stumpage it is of interest to see what has happened to stumpage prices in recent years. Prices in southeastern Minnesota and southwestern Wisconsin are somewhat above average for the Lake States, but trends there are indicative broadly of conditions throughout the region.

In the middle 1930's a farmer in Buffalo County, Wisconsin[2/], was offered 11

2/ Forest Research Digest, Winter 1939, U. S. Department of Agriculture, Forest Service, Lake States Forest Experiment Station, University Farm, St. Paul, Minnesota.

---

to 15 cents per tie by local commercial operators for his stumpage. This probably approximated the low point for the last decade.

Four medium-sized tie concerns which operate in nine southwestern Wisconsin and two southeastern Minnesota counties recently were questioned regarding stumpage costs. According to their figures, the average stumpage price per tie in 1940 was 27 cents; in 1942, 33-3/4 cents; in late 1944, 38 cents. Thus, 1944 prices were 38 percent higher than those for 1940 and were approximately three times those paid during the depression years of the middle 1930's.

Several factors are responsible for the rise in tie-stumpage prices. First is the general improvement in business conditions. Had it not been for World War II, it seems likely that the unit cost of tie stumpage would have gone to 20 to 25 cents after the depression, and more or less leveled off at that point. Second was the wartime inflation of values. Third was the increased demand for wood products and sharpened competition for stumpage. Fourth, farmers began to realize the real value of their woods.

Some of the other more important factors which have caused a rise in the costs of manufacturing ties are: (1) higher wage levels, (2) more costly materials, supplies, and equipment, (3) less efficient and less experienced labor.

During 1940-1945 the margin between cost and selling prices for ties, lumber, and slabs narrowed. Production records of four sizable southern Wisconsin mills during 1940, '42, and '44 clearly show this trend. These mills sawed an aggregate of 112,400 ties plus 675 thousand board feet of side lumber and

approximately 2,800 standard cords of slabs and edgings in 1944. On the basis of the data provided by the four companies, the following average figures are obtained:

Item	Unit	Costs		
		1940	1942	1944
1. Stumpage	100 ties	$27.50	$34.00	$38.00
2. Felling & bucking	100 ties	9.00	12.00	16.50
3. Skidding	100 ties	7.50	10.00	13.50
4. Loading & hauling logs; roadbuilding	100 ties	14.00	17.50	25.00
5. Milling-includes handling logs and manufactured products to point where they are seasoned or sold	100 ties, 600 bd.ft. lmbr.+ 2½ std.crds. slabs	17.50	22.50	29.00
6. Workmen's compensation, unemployment insurance, and social security	100 ties	7.50	8.50	10.00
7. Equipment, depreciation, supervision	100 ties	9.50	11.00	15.00
8. Piling, loading, & inspection	100 ties	3.00	4.00	5.50
9. Piling lumber	600 bd.ft.	.50	1.00	2.00
10. Grading & loading lumber	600 bd.ft.	1.50	2.00	3.00
Total cost of 100 ties, 600 bd.ft. lumber, and 2½ cords of slabs and edgings		$97.50	$122.50	$157.50

Units	Income					
	Total value			Percent of total value		
	1940	1942	1944 1/	1940	1942	1944
1. 100 ties	$91.00	$106.00	$137.00	76.0	75.4	77.0
2. 600 bd.ft.lumber	18.60	22.80	26.10	15.6	16.2	14.6
3. 2½ standard cords slabs, edging, etc.	10.00	11.87	15.00	8.4	8.4	8.4
	$119.60	$140.10	$178.10	100.0	100.0	100.0

1/ Includes dealer's commission.

Relationship of Costs to Income

Year	Total costs per tie	Gross income per tie	Margin for profit & risk	
			Per tie	Percent
1940	$0.98	$1.20	$0.22	22
1942	1.22	1.41	0.19	16
1944	1.58	1.78	0.20	13

The foregoing analysis is not necessarily representative of the costs and returns for the entire tie industry in the Lake States. Too many variables are involved to make such a generalization valid. It does show the upward trend of stumpage and manufacturing costs and the downward trend in profit. The low current margin for profit and risk is a real problem according to most operators and is not likely to stimulate additional production.

Competition from Other Industries

Another problem of the tie manufacturer is competition from other industries. In the Lake States the chief competitors are producers of veneer, quality lumber and dimension stock, furniture squares, and speciality products. The character of competition varies with locality and with the species, volume, and quality of stumpage. In northern Minnesota, for example, tie manufacturers are faced with very stiff competition from wooden-match stock concerns. The situation in Wisconsin and Michigan is somewhat the same. In these instances the pressure is exerted principally by the large commercial veneer mills and lumber manufacturing concerns. The exceptionally sharp demand for tamarack and northern cedar mine timbers, piling, and poles also has affected cross tie production adversely in some localities.

On the whole, the foregoing competitors can pay better prices for logs than tie producers; consequently they are able to take a considerable volume, especially hardwoods which previously went into ties. Furthermore, they take the highest grade material leaving mainly poor logs for the tie men. Since shrewd tie operators usually utilize veneer-quality logs for better paying products, the loss of this class of material reduces his over-all margin of profit. Few tie operators can afford to pay 38 cents per tie for stumpage when logs consist solely of No. 3 and the poorer half of the No. 2 grades. What ultimate effect competition will have on tie production in the Lake States region is difficult to predict. With the current construction boom and a prospective strong market for veneer, boxes, furniture stock, and other wood products, competition may be very strong for the next five or ten years. However, in the long run, it is believed that tie mills may regain some of the ground lost, primarily because they are much closer to the source of timber supply than most competing industries. These, in some cases, are hauling logs as far as 500 miles. They can afford this while they have a boom market but may not be able to do so under normal conditions.

Practicable Measures to Improve Situation

Despite major problems facing the industry, the future outlook for tie production in the Lake States is fairly bright. Several helpful measures can be initiated, viz., (1) little used species such as aspen, soft elm, soft maple, and black ash can be experimented with on a much larger scale--they may be better than expected; (2) costs can be reduced by improved logging and milling methods; (3) income can be increased by adopting better utilization standards and practices; and (4) logging can be done so as to perpetuate rather than destroy the stumpage base upon which the tie industry depends.

Experiment with Little-used Species

For many years railroad companies which purchased ties in the Lake States have given oak, sugar maple, and birch top rating. Notwithstanding this fact, a number of these companies found it expedient during the war years to use aspen, elm, soft maple, and black ash.

The tie manufacturers of the region would like to continue to produce ties from these species. They are abundant enough throughout the Lake States as a whole to offset the decline in the better hardwood species which will take place. The railroads, on the other hand, are not convinced that there is any satisfactory substitute for dense, durable hardwoods, such as oak. Apparently data are needed on the actual service rendered on main line trackage by such tie species as aspen, elm, and soft maple.

The possibility of utilizing aspen in greater volumes needs further exploration. This species occurs over large areas in pure, easily accessible, rapidly-growing stands. There are thousands of acres of aspen which have reached or are approaching a size suitable for ties.

Very little seems to be known concerning aspen ties. A few recent observations made by tie men indicate that: (1) they demand closer inspection than most other species because of inherent defects; (2) they check badly and are subject to rather heavy fungus attacks during seasoning; and (3) they take preservatives irregularly.

Although some railroads are prejudiced against aspen ties, others believe that they may prove entirely satisfactory for straightaway and secondary tracks. Several railroads rate properly seasoned and treated aspen ties on a par with western fir and pine ties. However, the price differential favors the western species at present.

If aspen, by a series of service tests, proves to be acceptable as a tie species it seems likely that soft maple, soft elm, and black ash also will be used more widely. While these latter species may not come up to aspen in some ways, they surpass it in others. For example, southwestern Wisconsin tie producers repeatedly have commented on the low percentage of defect in soft maple.

The aforementioned species are abundant enough over the Lake States as a whole to offset the decline in the production of the better hardwood ties which can be anticipated. However, before aspen or any of the other so-called less desirable species will be widely used as ties, several of the detriments mentioned above must be partially if not entirely overcome. This is a challenge to research. Further experimentation should be directed along the following lines: (1) find better methods of seasoning and treating aspen; (2) improve or alter the design of mechanical devices. Life expectancy of ties made from little-used species might be increased by using wider tie plates and nail or screw type spikes having greater wood holding capacity; (3) devise a cheap method of hardening wood through plastic coating; and (4) continue service tests of these species under all types of conditions, weather, traffic, etc.

Improve Logging and Milling Methods

At present, sawing and handling of railroad ties is done mostly by manual labor. Men live and work under adverse conditions. Their employment is seasonal and very hazardous. As a consequence labor turnover is high.

The tie manufacturing industry must improve the methods used in harvesting, manufacturing, and handling ties to attract first-class workers. More complete mechanization would eliminate much of the strenuous physical labor now required. Mechanization could reduce costs greatly, especially if equipment was modified to suit logging conditions. Moreover, it would have a desirable psychological effect on workers, i.e., they would feel that the industry is keeping up to date.

A program for training workers to do their jobs safely and correctly would reward the industry in less labor turnover, greater efficiency, and lower production costs. The installation of safety devices would have the same desirable effect.

There is need for a thoroughgoing study of the tie-manufacturing business all the way from tree stump to finished product to find cheaper and more efficient methods of logging and milling. Among the questions needing answer are: Should felling and bucking be done by power saws or by hand? Should skidding be done by horses or by caterpillar tractors? Is it cheaper to skid the entire tree, bucking it into logs at a central point, or cut the logs in the woods? What are the merits of power loading devices mounted on trucks as compared to small, highly portable jammers? Is full advantage taken of topography in felling, skidding, and decking logs? Is it more economical to haul logs or the finished products the longer distances? Should both milling and logging be carried on throughout the year, or should woods work be concentrated in late fall, winter, and early spring and milling during the other seasons of the year? (Some operators claim sawing costs rise sharply when temperatures drop sufficiently to freeze logs all the way through.)

At the mill, what is the best way to deck and handle logs? Can this be done more efficiently and cheaply by hoists mounted on trucks or by chain conveyors? Among the widely varying mill layouts, what is the best location for the head-saw, live rolls, edger, cut-off saws, and planer? Would it save time and money to segregate lumber into rough grade categories (say No. 1 common and better in one class, and No. 2 and No. 3 common in another) at the green chain rather than leave all grading until after the lumber has been piled for drying? Have the possibilities of mechanical devices for piling, loading, and hauling lumber, ties, and slabs been explored fully? In the sales end of the business, can more money be made by a quick turnover of products or by timing sales to coincide with top market prices? Is the operation sufficiently flexible to permit switching from one product (ties) to another (mostly lumber) when market differentials develop suddenly? Are standardized business methods employed, and are records complete enough so the mill owner can single out the particular steps of the operation which are losing money?

It is self-evident that all tie mills cannot be operated by the same formula with regard to logging, milling, or sales. The problems of the southwestern Wisconsin mill producing hardwood ties from farm woodlands will be considerably different from those of the northern Minnesota mill making softwood ties from relatively remote, rocky, or swampy country. Nevertheless, most mills can be helped greatly by getting answers to the questions enumerated above.

Seek Better Utilization

One of the problems in utilizing hardwoods in the Lake States region is to find a profitable outlet for sound, low-grade logs. No. 1 and the better No. 2 logs always are salable for veneer, quality lumber and dimension stock, turning stock, specialty products, and the like. On the other hand, the poorer No. 2 logs and the No. 3 logs usually are hard to sell. Technicians who advise farmers and other owners of hardwood timber should stress the fact that these latter grades of logs often can be used more profitably for ties than for low-grade lumber.

Many farmers are beginning to realize that they are "short changed" when they sell whole blocks of timber. As a result they are inclined more and more to do their own woods work and sell logs rather than stumpage. Log-making and skidding are not beyond the ability of the average farmer and at current rates will increase his gross income by at least $8 per thousand board feet of logs. If he delivers the logs to a sawmill or a railroad siding he can collect an additional $5 to $7 per M. In short, his total return for stumpage, log-making, and hauling amounts to about 50 percent of the sale value of graded lumber f.o.b. cars.

Another means of accomplishing good utilization is to develop further the pool idea of selling. Farmers cut hundreds of thousands of tie bolts, and at times even veneer quality logs, into stove wood simply because individually they have only 1 to 2 thousand board feet of such material--too little to be attractive to a timber buyer. If 25, 50, or 100 farmers would pool these logs, sort them, and offer them in carload lots they would be much more salable.

A further aid to better utilization would be logging and log-grading demonstrations. These would provide the timberland owners with a more definite idea of which trees should be cut, how they should be felled, and how they should be bucked into sections to yield the highest monetary return. The most profitable use (veneer, lumber, ties, bolts, fuelwood, etc.) for each class of logs or other material likewise would be pointed out.

Encourage Better Forest Management in Farmwoods

For some obscure reason, the railroad cross tie never has occupied a place comparable to veneer, quality logs, and specialty products in forest management planning in the Lake States. Most foresters and woodlot owners rate the production of tie bolts little above the production of cordwood as a silvicultural objective. This point of view is most unfortunate since management of the hardwood stands of the region cannot be accomplished without improvement, intermediate, and salvage cuttings. Such operations will yield large quantities of sound, low-grade logs, one of the most economic uses for which is railroad ties. Furthermore, even trees of veneer quality produce a certain percentage of tie logs.

In some cases it is advantageous to manage hardwoods primarily for the production of tie bolts. Recent studies of oak farmwoods have shown that on poor and medium sites, especially when stocking is below normal, ties will yield as good a profit as lumber. Conversely, on good and very good sites with near-normal forest density there is a decided financial advantage in converting the better logs into lumber or selling them for veneer.

As a matter of fact, the astute operator recognizes the foregoing principle. In one recent case, a tie producer got out a number of 10 to 16 foot quality logs and sawed them into lumber. Subsequently, this material was mixed with 35 M board feet of tie sides which as a component of random length boards commanded about $12 more per M bd. ft. than would have been the case had the 8-foot lumber been sold alone.

There has been some recent improvement in logging practices by tie operators. For example, three concerns in southwestern Wisconsin manufacturing about 150 thousand ties plus several million board feet of lumber and dimension stock annually, leave all trees less than 13 inches d.b.h. Admittedly, this is too low a standard for mixed oak and northern hardwoods, but it is a step in the right direction. Moreover, there are a number of factors that may contribute to conservation practices in the near future. Some of these are: (1) a growing appreciation for woodlands by farmers and timber owners almost everywhere in the region and consequently a greater reluctance to sanction clear cutting; (2) improved marketing facilities (pools, co-ops, etc.,) where special emphasis is given to the quality of logs rather than quantity; (3) more logging by farmers and owners of small timber tracts - more selling of logs rather than stumpage; and (4) the growing demand by railroads for larger ties which should reduce the drain on small (10-to 13-inch) sawlog trees.

If the supply of raw material essential for the tie business is not to be exhausted, operators must resist the temptation to over-cut. Some of the causes of over-cutting in the past have been: (1) rapidity with which more or less even-aged, nonmerchantable hardwood stands, especially oak farmwoods, have become merchantable during the past 10 to 15 years; this has created an illusion of timber abundance. In clear cutting whole blocks of those farmwoods, the operators lose sight of the fact that it took 70 to 100 years to produce these stands. Thus the rate of depletion far exceeds the growth; (2) indifference of farmers and other timber owners to clear cutting by operators; at least a part of this excessive depletion should be avoided if farmers would insist upon written contracts which stipulate that trees below a certain size are to be left in reasonably good growing condition; (3) temporary character of operator's business. Many tie producers are not particularly interested in timber conservation; they obtain stumpage by moving frequently and eventually when the timber supply runs out they liquidate their investment and go into some other business.

CONCLUSION

The tie industry in the Lake States has been beset by many complex problems in recent years. Some of these problems are of a temporary nature and can be partially if not entirely overcome. Others are more serious. One very critical problem is the short supply of operable timber and the competition from other wood-using industries for stumpage, logs, and bolts. Although competition for raw materials was greatly increased by war demands, the problem is by no means a temporary one. The war merely hastened a trend already well defined.

The capacity of wood-using industries is clearly too great for the amount of operable timber remaining in the Lake States. Because of this excess capacity it is reasonable to assume that only the most efficient wood-using plants will be able to operate profitably in the years ahead. This situation is a challenge to the tie industry as well as to other wood-using industries in the region.

Just how well the tie industry will fare in the future depends on the initiative and foresight of the leading operators. If they can put their logging and milling operations on a highly mechanized and efficient basis, there is no reason why they cannot compete on equal terms with other industries for the grades and species of timber most suitable for ties. Beyond that, however, leaders of the industry must make their contribution toward conservation of timber stands. They must develop less wasteful cutting practices than have been used in the past. They must learn to utilize some species and grades of material previously rejected. They must encourage farmers and other small land owners to handle their woodland for sustained production and to restore denuded areas. Unless constructive steps are taken it is unlikely that even the present rate of tie production can be maintained.